**AP STAT: Ch. 6 Normal Model and Standardizing**

* 1. You are in a history class and a math class. You take your chapter 1 test in both classes on the same day, and get them both back a few days later. Your grades are as follows. Which class did you do better in?

*History: 81% Math: 75%*

* 1. Same scenario. However, each teacher tells you a bit about how your class did. Which class did you do better in?

*History: 81% Math: 75%*

*mean: 76% mean: 70%*

* 1. Same scenario. However how your teacher gives you the class standard deviations. Which class did you do better in?

*History: 81% Math: 75%*

*mean: 76% mean: 70%*

*std. dev: 8% std. dev: 2.5%*

**Standardizing Observations**

**Question:** How can we compare one distribution to another distribution if they don’t have the same parameters (mean and std. dev)?

**To standardize:**

* + measure observations….
  + Z =
  + Z- score tells us…

**Example:** The heights of 18-24 year old women are distributed with the following:

**μ = 64.5” and σ = 2.5”**

We know a woman who is 69” tall. How does she compare to the rest of the women in her age group? Calculate her z score, and interpret what it means.

**Example:** We also know a man who is 71” tall. Who is taller relatively? Men are known to be distributed with a mean of 67” and a std. deviation of 2.3 inches.

**Changing/Manipulating a set of data**

What did we learn from the linear transformations wksht??

Adding/Subtracting a number just changes…

Dividing/Multiplying a number changes….

Did the shape change in any of these???

**Example:**

Set of data: {2, 3, 3, 4, 4, 4, 5, 5, 6} Type this into L1

1. Find the mean and std. deviation and the shape
2. Take the entire set of data and convert to z-scores (subtract the mean and then divide by the std. deviation). Do this in L2.
3. Calculate the new mean and std. dev (of L2). Why is this so?
4. What does the shape of the distribution look like?

This will happen with ANY distribution…. When you change the whole thing into z-scores, your mean will be \_\_\_\_\_\_\_\_ and your std. dev. will be \_\_\_\_\_\_\_\_\_\_\_\_.

**Graphs for Samples: Described by STATISTICS**

**Model for a population: Described by PARAMETERS**

**Specific type of population….**

**Notation:**

**Notes on Standardizing a distribution:**

* + Standardizing one observation…
  + Standardizing a whole distribution allows us to….
  + Normal distributions…. When we standardize them, we get the:
  + Can only be used for…
  + How can we check if data is NORMAL?

**Empirical Rule**

In a normal distribution with N(μ, σ)….

* + \_\_\_\_\_\_% of the observations fall within \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + \_\_\_\_\_\_% of the observations fall within \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + \_\_\_\_\_\_% of the observations fall within \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Example:**

The avg. time that it takes a crew from Sweeper Sam to clean a room is normally distributed with a mean of 2.1 hrs and a standard deviation of 0.3 hrs.

1. The total clean up time will fall within what interval 95% of the time?
2. What proportion of the time will it take the crew 2.5 hours or more?
3. What percent of the time will it take the crew 1.5 hrs or less?

**Back to the height example….**

Remember that the heights of 18-24 year old women are N(64.5”, 2.5”). What percentile is the girl who is 68” tall?

**Calculator:**

What percent of 18-24 year old women are less than 5 feet tall?

What percent 18-24 year old of women are over 5’8” tall?

**Another example:**

Blood pressures of high school students are N(170, 30). What is the probability that a randomly selected high school student has a blood pressure of 180 or above?

Using the same data as above, what is the probability that a high school student has a blood pressure between 160 and 230?

Using the same data as above, what blood pressure has 25% of the observations below it?

**WORKSHEET 6A**

1. **Suppose the average (mean) price of gas in a large city is $1.80 per gallon with a standard deviation of $0.05.**
2. Convert $1.90 and $1.65 to *z*-scores.
3. Convert the following *z*-scores back into actual values: 1.80 and –1.60.
4. **Suppose the attendance at movie theater averages 780 with a standard deviation of 40.**
5. An attendance of 835 equals a *z*-score of:
6. A *z*-score of –2.15 corresponds to an attendance of:
7. **A packing machine is set to fill a cardboard box with a mean of 16.1 ounces of cereal. Suppose the amounts per box form a normal distribution with a standard deviation equal to 0.04 ounce.**
8. What percentage of the boxes will end up with at least 1 pound of cereal?
9. Ten percent of the boxes will contain less than what number of ounces?
10. Eighty percent of the boxes will contain more than what number of ounces?
11. The middle 90% of the boxes will be between what two weights?
12. **The life expectancy of wood bats is normally distributed with a mean of 60 days and a standard deviation of 17 days.**
13. What is the probability that a randomly chosen bat will last at least 60 days?
14. What percentage of bats will last between 40 and 80 days?
15. What is the probability that a bat will break during the first month?
16. **Given a normal distribution with a standard deviation of 15, find μ if 15% of the values fall above 80.**
17. **Given a normal distribution with a mean of 25, what is the standard deviation if 18% of the values are above 29?**

**WORKSHEET 6B**

1. **The life expectancy of a particular brand of light bulb is normally distributed with a mean of 1500 hours and a standard deviation of 75 hours.**
2. What is the probability that a light bulb will last less than 1410 hours?
3. What is the probability that a light bulb will last more than 1550 hours?
4. What is the probability that a light bulb will last between 1563 and 1648 hours?
5. 15% of the time a light bulb will last more than how many hours?
6. **A water fountain is designed to dispense a volume of 12.2 oz. with a standard deviation of 0.5 oz.**
7. What percentage of cups end up with at least 12 oz.?
8. 75% of the cups contain more than how much water?
9. Find the IQR for the amount of water dispensed.
10. Find the 90th percentile for the amount of water dispensed.
11. **Given a normal distribution with a standard deviation of 10, what is the mean (μ) if 21% of the values are below 50?**
12. **Given a normal distribution with 80% of the values above 125 and 90% of the values above 110, what are the mean and standard deviation?**